ICI magazine

September/October 1968

1

2

3

4

5

6

7

ICI magazine

Volume 46 Number 344

Front cover

Far down among the woodlands, orchards and vineyards of Southern Germany stands the medieval village of Oestringen, whose rooftops are seen on our front cover and whose ancient arms appear opposite, next to the ICI roundel. Just behind the casual pattern of those roofs a more regular outline emerges: the gleaming white oblong of ICI (Europa) Fibres synthetic fibre plant. Initiated by British Nylon Spinners in 1963 as a major investment inside the growing European Common Market for man-made fibres, the Oestringen works was put up in 20 months after careful consideration of the best possible site for the new £13m venture. The first nylon was spun in April 1965. Since then a plant originally designed to make 37m lbs of yarn a year has reached an output of 50 million, Terylene included. The village, its land and its people made possible the creation of the factory. The factory has re-charged the energies and hopes of a traditional community. See our report in this issue, 'Oestringen: the horizon expands', on page 132.

Photograph: Helen Chillingworth

ICI Magazine is published for employees every other month, price 4d. Articles, photographs and suggestions for articles are invited from members of the Company. They should reflect the writer's own experience, interests or ideas. Payment is made for those accepted. The Company does not necessarily endorse contributors' views.

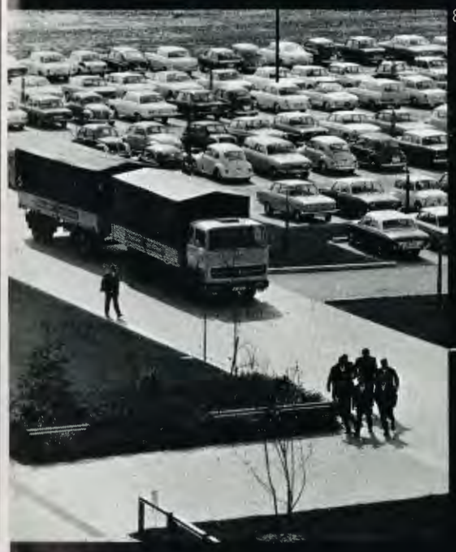
Published by Imperial Chemical Industries Limited
Imperial Chemical House, Millbank, London SW1

Editor Francis Odle

Printers The Kynoch Press, Birmingham

ICI

Oestringen: the horizon expands



8

9

10

1 Village street, Oestringen

2 Stefan Piesker of ICI (Europa) Fibres GmbH staff explains nylon production to visiting children from the local Pestalozzi school

3 Artur Volz, head of the works fire brigade, with fire tender. He is also a member of the local Oestringen council

4 Bell given by ICI to Oestringen Parish Church. It weighs about 7,000 lbs, measures 68 inches across, and is dedicated to St. Andrew

5 Nylon comes in these special containers from the ICI (Holland) plant at Rozenburg – 711 miles away

6 Works buses leaving the factory

7 Erwin Boeser, a servery worker in the canteen, ties up his vines. A light white wine is made in the Oestringen district

8 Car park in factory area, which holds 344 cars

9 Lourdes grotto opposite the church

10 Front view of Oestringen works

Oestringen

Dr. Edmund Klockner, works director, holds his weekly technical conference. Left to right: Christian Baumgarten, chief engineer; Dr. Erich Schmidt-Kraepelin, works accountant; Dr. Hans-Joerg Gilg, area manager, spinning; Dr. Reinhard Muth, deputy technical manager; Ilse Gaertner, directorate secretary; Dr. Klockner; Werner Wascheszio, production services manager; Dr. Waldemar Heckmann, production manager; Wolfgang Wetzel, area manager, draw-twist; Dr. Sepp Wagner, head of technical information department; Hans Schrotz, maintenance engineer

a factory comes of age – in 3 years

'You have to pass a pioneer time,' says Dr. Edmund Klockner, works director of ICI (Europa) Fibres' plant at Oestringen from its beginnings in 1964, 'and then, as the company grows, you grow with it. Now we have reached 50 million lb. a year, and are setting our sights on doubling or trebling our output within a few years.'

A graduate in physical chemistry from the University of Bonn, Dr. Klockner, quiet in voice and manner, spent 14 years with a leading German viscose filament company and another two with a major manufacturer of chemical plant before joining ICI in 1964. His job is to produce the fibres, to guarantee their quality, and to keep down costs, much as it would be in the UK. His weekly technical conference, however (*shown above*), he feels is very much his own idea: 'Once a week I meet the heads of production, engineering, planning, development, quality control, and works accounting. They all come along and talk about their problems and it keeps us in touch.'

While output at Oestringen has risen and become varied (it now includes not only a wide range of textile yarn but also yarn for other important end uses such as tyre cords and carpets), labour costs have been progressively reduced. Economies worked out in the plant have cut the cost per kilo of product by 30 per cent inside one year. Damage to bobbin sleeves was also cut from 50 per cent to 7 per cent, while the use of larger packing cartons saved 30 per cent on packing costs. Within the last three years, productivity has therefore gone up by 35 per cent. 'We started up with 100 men and have now built up to 1200, using the four-shift system seven days a week. At first we thought we would need 1400 or even possibly 1600 operatives, but 1200 are enough for our current production.

'We can increase output in two ways: by improving processes and by extending the plant into the internal space originally allowed for the purpose. There is also a lot of extra space beyond our present boundary – seven times more than we now occupy – and if we need more the burgomaster of Oestringen, Herr Hermann Kimling, who has been so helpful since the beginning, would let us have it.'

A keen gardener and walker, Dr. Klockner lives in a village near Heidelberg and enjoys long walks in the hills with his family. In winter they go ski-ing in the Black Forest resort of Freiburg.

'Before this factory came', says Herr Hermann Kimling, the ruddy-cheeked, robust burgomaster of Oestringen, 'it was hard to find enough work for our men and women. People were leaving and the village was beginning to stagnate. But when ICI arrived, they offered many jobs and a workplace, on our own doorstep'.

Today, one villager in three – 500 men and 100 women – has a job in the

:the horizon expands

Dr. Edmund Klockner

Herr Hermann Kimling

Dr. Erich Kersel

factory, while since it went up the population of Oestringen has also gone up by 500: an increase of 12 per cent in less than four years. One effect of the greater prosperity and more local work is the survival of farming as a spare-time activity. 'Many of our villagers, now that they have more money coming in, can invest in modern equipment and work their land with much less labour. Quite a few farms have been given new life like this.' Which explains why one sees many an employee on his day off pruning his fruit trees or looking after his vines. To Hermann Kimling, a dynamic man with a driving belief in his community, the coming of ICI has solved more than employment problems: 'Our cultural activities are now thriving more than ever, with two new schools in hand, a grammar and a primary. We are looking ahead. Already we are building a sports ground and later, perhaps a swimming pool.'

'I joined in the early days, late in the summer of 1964,' says Dr. Erich Kersel, personnel director. 'My job was to build up the whole working force, staff and payroll. This was a very big challenge: when we started up, the economic climate in Germany was very favourable and it was hard to attract people. So we had to do a lot of advertising, and we even went out into the surrounding towns and villages and talked to the local inhabitants up to a radius of 20 miles around.'

Since reading economics, business administration, and industrial psychology at the University of Goettingen, Dr. Kersel has specialised in personnel work. 'We didn't build up all the existing departments at once. First, we needed purchasing experts to buy in the materials; then maintenance people to help the contractors and the architects; then more and more administrative people. And since I couldn't do everything on my own, I also had to create the personnel department. I chose my own team of 17 staff, all of whom are still with me.'

Production began in April 1965 with a small nucleus of some 70 foremen and chargehands plus technical employees. Many of these people were new to the work but all of them were successfully trained in the UK company. 'Although we have reached full capacity now, we are still growing, especially in departments which deal with customers.'

Half-Austrian, Erich Kersel returns with his wife and three children to the mountains, among which he grew up, as often as he can. Within six hours of leaving the factory he can be ski-ing on the slopes of western Austria.

Walter Albrecht, assistant foreman, checks job sheets with draw-twist operatives Adolf Schaubschlaeger, Dieter Pechman, Winfried Kaiser, and Ewald Kamuf

Oestringen: the horizon expands

Hilde Hassis, laboratory assistant, textile development department

techniques for textiles

'There's an immense amount of technical knowledge in ICI. The problem for the overseas plants is how to use it,' says Ken Garland, technical manager. 'I serve as a link between the local organisation here and the UK. On the whole the technical people here have done the job they were meant to do – although it can be hard sometimes to convince your own organisation that the UK technical answer is the right one . . . there's a tendency to solve one's own problems in one's own way. Occasionally we have done things ahead of the UK.'

In his present job since March 1965, Ken Garland, a Southampton University graduate in chemistry, has a long experience of technical work in the man-made fibres industry, going back to 1951 when he first joined British Nylon Spinners at Pontypool.

In a plant which raced right up to full output from nothing in less than three years, the pace of technical development has been pretty hectic right from the start and is now likely to become even more so. When Terylene manufacture began in February 1967, for example, there were only three people at Oestringen with more than three years' knowledge of the fibre. They simply had to get on with it and make their way in a new market, which, like all textile markets, suffers tremendous though often relatively short-term ups and downs. 'Our successful entry into Europe at a most difficult time has made a massive impact. I don't think we quite expected the success we are having, and it's very satisfying, after many struggles, to find things going your way.'

Ken Garland

In charge of the day-to-day work of the textile development department, under its director Dr. Percy Hatfield, is Gwyn Simmonds, who controls a staff of 80 (of whom nearly half were recruited locally). He also links up with sales and marketing in Frankfurt and with production on the plant. 'Most of our work – about 60 per cent – is technical service for our Common Market customers – Germany, France, Belgium, Holland, Italy. We also do some development work, but there is a different kind of demand over here. Things originally discovered in the UK sometimes find a quicker and more rewarding response in Europe. And the customer may ask for things the British don't want anyway – like a yarn which gives a coarser 'handle' to pullovers and outer garments than is liked in Britain. So we make it.'

Left to right: Theresia Brand, sample preparer; Anne Gabel, seamstress; Gwyn Simmonds and Brigitte Fellhauer, at work in the textile development department

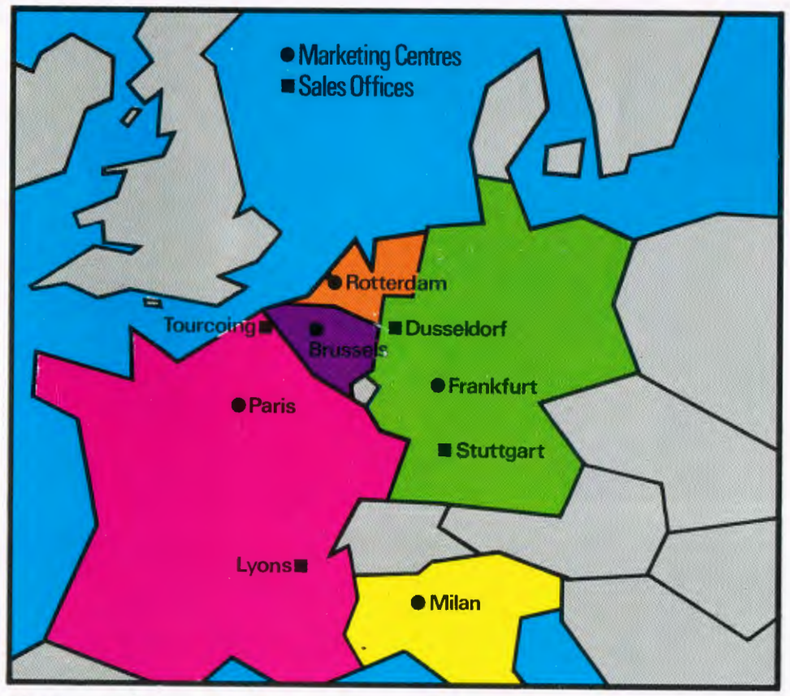
The customer in Germany is used to more attention because competition is so much keener. 'While in England we often found that a customer would do a lot of work himself, here they expect you to do pretty well everything for them. This is especially true in dyeing and finishing, where they have always wanted you to match all their shades and then take the responsibility for the colour being right. We are carrying on this kind of service because if we don't, our competitors will! Europe is a much bigger working area than England and distances are longer. We go all over the place, mostly by air. One day Paris, the next Hamburg. But this is all part of living and working in Europe. On holidays or weekends we often just jump into the car and drive the 150 miles to Switzerland. Distances may be greater – but other countries feel nearer.' A favourite weekend place for Gwyn Simmonds, a keen trout fisherman, is a small guest house on a small river in the Black Forest – the Kleine Kinzig.

Helmut Ensslin, in charge of the bulking and knitting department under Gwyn Simmonds

Dr. Reinhard Muth, deputy technical superintendent, is also in charge of the physical and chemical laboratories

Christa Scheuerer, textile technician, compares samples for fastness to light against the standards card

Oestringen: the horizon expands



ICI (Europa) Fibres: the marketing pattern

fibres for Europe

'We have a very good basis for going ahead,' says Tom Howie, general manager, ICI (Europa) Fibres, at his Frankfurt headquarters 'We have the people, the organisation, and the technical background.'

'I look to ICI (Europa) at Brussels on any matters concerning us as a European company – and I look towards ICI Fibres Ltd. in Harrogate as a company concerned with making and selling fibres. But I am by no means the only link: there is day-to-day contact, especially between ourselves and Harrogate. My overall deputy, Peter Beazley, who controls the commercial side in Europe, is in constant touch.'

An engineering graduate from St. Andrew's with what he calls a 'good smell' at textiles and chemicals, Tom Howie has three times in his career started up a complete manufacturing and marketing operation from nothing. Back in 1946 he was closely concerned with the planning, building and commissioning of the first major nylon site at Pontypool for BNS. In 1956 he went out to Australia to build and commission another new plant. Finally, in 1964 came his biggest, toughest job: a launching operation inside Western Germany, a formidable competitor to Britain both in chemicals and textiles.

'Here in Germany we do not operate as a Division of ICI, but as a German company for which I myself carry the legal responsibility. As a subsidiary private company we have no board in the English sense, and no company secretary. If anyone goes to jail for a breach of company law, it's the boss! So even though my German is now much better than it was when I came out, not knowing a word, and did a 'crash course', I depend far more in all legal matters on our finance director, Dr. Hans Muller, than I would at home. During the establishment of the works at Oestringen I was of course also very dependent on Dr. Klockner, the works director, Dr. Hatfield, the textile development director, and Herr Bretschneider, the purchasing director.'

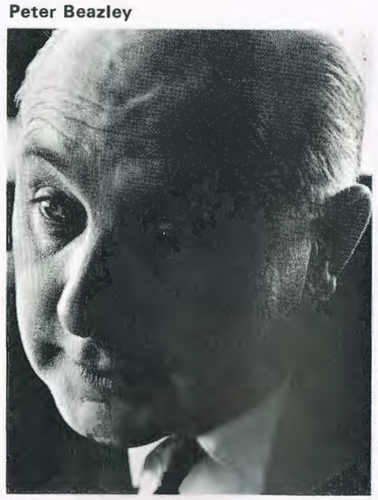
A spell in Europe, he feels, would do a lot of people in the UK company a lot of good – if they could get back to a worthwhile job afterwards: 'We always need ICI people, especially for technical service work. And we think that after their time with us, they will be more useful to ICI as a whole.

Leading a busy social life in Germany Tom Howie confesses to missing one thing: golf courses. 'If I'd kept my office at Oestringen, as it was when I spent a lot of time there, I think we'd have had a nine-hole course round the perimeter by now . . .'

'The first thing to do when I came here was make a profit forecast.

Tom Howie

Peter Beazley



Sales were static at five million lb. a year, yet here was a plant coming on stream designed to produce 37 million lb. a year, which could easily reach 40 million, if not 50. Could we go to 15 million inside twelve months? And could we then press on to 30 and 40 million? Our plans, therefore, called for a tripling of our sales in the first year, and then a doubling of that. Which we did.'

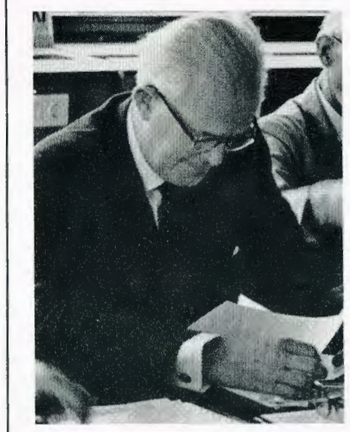
In over twenty years with ICI, Peter Beazley, who read PPE at Oxford and speaks fluent French, German, Italian and Portuguese, has specialised in sales, marketing, and exports. Between 1957 and 1965, when he took up his present post as deputy general manager, ICI (Europa) Fibres Ltd., he was sales control manager and later marketing manager of his Division.

His main task is to develop the market in Europe for the output from Oestringen. What made things harder was the dramatic decline in market conditions between 1961, when ICI first went into Europe, and 1965 when production began.

In 1961, nylon commanded high prices, the market was growing fast, and there was a shortage of capacity in the EEC countries. By 1965, there was a lot of over-capacity and prices were falling sharply. Yet there were still encouraging features: 'Even though output as a whole exceeded demand, some factors were in our favour. For example, the plant had been designed mainly to make bulking yarns (used for sweaters and socks) and this turned out to be the best area in which to develop our sales. But it's no good relying on one product, so we also built up strength in the market for continuous filament yarn used to make carpets, and this too has done well after some early troubles with quality.'

In what time he has to spare, Peter Beazley seems quite the European: 'I enjoy living in Germany very much, although it has meant giving up golf, bridge, and gardening, because of the pressures of the job. When I can I ski – very badly – take a rare walk in the country, go to the opera or theatre about once a month, and dabble in history, architecture and painting. I like German white and French red wines – and German song birds.'

'The Common Market is not so common as it sounds,' says Peter Schmitt, head of the German fibre sales company, 'and in Germany, the biggest, fattest market of them all, the national producers are trying hard to protect their share of the market. We also face sharp competition from Italy and France. But we have a big share of the bulked yarn market in Germany, and in the last two years we have more than doubled our share of the carpet trade.'



John Townsend, ICI Director, and chairman, ICI (Europa) looking through some plans when he presided at a recent meeting of the ICI (Europa) board held in the Oestringen plant

In charge of all sales and marketing in Germany, with a staff of some 50 people, Peter Schmitt is a specialist in managerial and marketing matters, with university training in economics, statistics and sociology, both in Germany and the USA. 'We did not have much chance,' he explains, 'to build up in the classical way. The time was too short and the sales targets too high for that. I had to make up my mind, starting as I did with few people in 1964, whether to chase around for business myself, and sell a couple of hundred pounds of yarn here and there, or create a large scale selling organisation – quickly.'

In his eyes, the British have some way to go before the old outlook of 'fog in the Channel – Continent isolated' completely disappears, but he is very encouraged by the growing international thinking within ICI which has adapted remarkably well to the sharper competitive atmosphere.

Although he and his team have established themselves firmly with a good share in profitable parts of the existing market, there are still many fields to conquer. The market is growing fast and ICI has a lot to contribute with its new products. As a change from his high-pressure existence, he likes to play the harpsichord and watch his roses grow.

'The main difference between this market and the UK,' says Fred Thomason, commercial manager, ICI (Europa) Fibres, who looks after marketing in all the EEC countries, Germany excepted, 'is that here we are fighting strongly-entrenched competitors. In every other foreign market where ICI has sold fibre before, the Company has either been first in the field or had some protection.'

A Manchester University graduate in commerce, Fred Thomason studied for five years at evening classes to gain further qualifications in textile technology, at the same time keeping on with his French and German, before he joined ICI in 1959. Dealing with five highly-individual customer countries, he is on the move most of the time. Hardly a week goes by when he is not away from base, advising one or other of his marketing teams. 'In this business, we don't want to sell direct on a commodity basis. Our job is to push our products in at one end of the market and pull them out at the other. To do this, we must organise the mass of the European textile industry in between, so that we take our promotions right through from the manufacturer, through the retailer, to the customer.' In his spare time Fred Thomason swims in local lakes or rivers in summer, skis in winter – and visits other parts of Germany by car as often as he can.

Peter Schmitt

Fred Thomason

Photographs: except monochrome, pp 134–5 and in panel above, John Chillingworth

old Bentley v new Mini

Anthony Saunders

Asked which would be the cheaper car to run, a pre-war 3½-litre Bentley or a modern 'Mini', most people would answer, 'The Mini.' But they could be wrong, says Anthony Saunders, who writes from experience as the owner of a 1934 Bentley and is a member of the Bentley Drivers' Club.

Among the British car manufacturing firms forced into liquidation by the great financial slump of the early 1930s, none was better known or more respected than Bentley Motors. In only ten years, a small group of dedicated men led by W. O. Bentley had created an unparalleled reputation for high-quality, high-performance cars. The quality was exemplified by the five-year guarantee which accompanied each new car; the performance, by the way some cars, straight from the works, were tested at up to 110 miles an hour on the Watford By-pass (rather less crowded in the 1930s than today).

This speed, with acceleration to match, and in a car weighing two tons, was a fine achievement 40 years ago – but few people could own sports cars like these. They were expensive to build and sold for between £1,200 and £3,000, which even today, with our devalued 1968 pound, is more than many can afford for a car.

Bentley Motors was eventually taken over by Rolls-Royce, who, by 1931, were world-famous for producing beautifully-engineered, luxury cars. There was much speculation and interest about the possible results of this marriage of speed and luxury. The outcome was the 3½-litre Rolls-Bentley – and when it was introduced in 1933 it was unrivalled for sheer, all-round quality. It also offered spirited performance, being able to reach almost 100 miles an hour in silence, with acceleration bettered by only a few cars at the time.

By the late 1940s, after the war, the country had gone through tremendous social and other changes. Poorly-paid craftsmen were being replaced by machines, labour costs and material prices increased, and the hand-built motor car had given way to one which was more practical and functional in design and more economic to produce. Cars were no longer only for the rich but for a much wider market.

Despite these changes, designers still managed to produce cars which became classics in their own right, such as the faithful Morris Minor, the sleek Jaguar XKs and, in the late 1950s, the ubiquitous 'Mini'. Little need be said about the 'Mini' concept. Compared to the pre-war Rolls-Bentley it is smaller, more practical and much more economical to run. Or is it really so much more economical?

Surprisingly, or even unbelievably to some, the last part of this comparison may not be true. It is certainly not so in the case of my own 1934 Bentley 3½-litre saloon, for its annual running costs are lower than those for a 1967, 848 c.c. 'Mini', taken over, say, a three-year period.

In the following comparative table the Bentley figures are for my car, which I bought for £150 and on which I have spent £300 in restoration. On today's market it would sell for about £450. Using low-grade petrol, the Bentley 3½-litre records between 18 and 20 miles to the gallon and in the table an annual mileage of 10,000 is assumed for both cars.

	Bentley	'Mini'
Fuel	£154	£74
Repairs	300	15
Insurance (comprehensive, with full bonuses)	16	13
Tax	25	25
Oil and Service	10	15
Tyres	14	12
Depreciation	–300	80
	£219	£234
Cost in pence per mile	5·25	5·6

So lack of depreciation on the Bentley more than compensates for the high petrol consumption and costs are also kept down by the need for servicing only once in every 5,000 miles and by the reasonable insurance rates available through the Bentley Drivers' Club.

Admittedly, however, the picture changes if major professional repairs are needed. Then I would rather have the 'Mini' any day, and the following table shows why:

	Bentley	'Mini'
Rebuilt engine/clutch	£350	£65
Decarbonising valves etc.	40	12
Respray/retrim	300	75
Brake overhaul	90	15
Clutch overhaul only	40	—
New exhaust system	100	5
(So-called 'cheap' repairs are possible with both cars but are not considered here.)		

The high repair charges for the Bentley result from the amount of work involved. However, the '3½' is still a current model for spares, as far as the makers are concerned, so most normal running spares are still obtainable. If fitted, they would probably outlast the car, so are therefore not very expensive in the long run – with the notable exception of the exhaust system. The 5·50 × 18 in. tyres for the car are still made by India Tyres, but if they ever became scarce this would create more difficulty than anything else in keeping the car on the road for everyday use.

The prices of all pre-1939 cars could possibly rise rapidly, as has already happened with the 'Vintage' cars of the 1920s, but it is still possible to buy a reliable, good-looking example of a 3½- or 4¼-litre (the later model) pre-war Rolls-Bentley for the cost of a new 'Mini'. A perfect example, with chassis and coachwork gleaming in 'as new' condition, would cost something like the 1930s selling price of £1,500 to £2,000, but quite apart from the economy of running it could be considered a bargain in another way. It will hold its price – and if a 3½- or 4¼-litre Bentley were to be built today, using pre-war hand-finishing methods and materials of similar quality, the cost would approach £25,000!

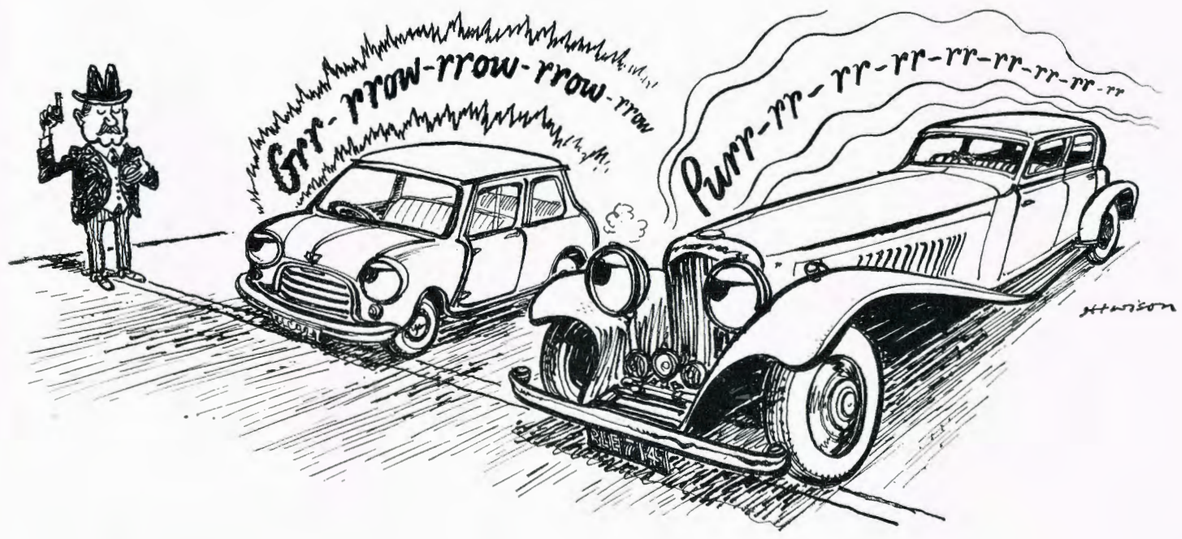
But to return to more realistic prices around £500, what other advantages does the Bentley have over the modern, popular car? There is 'one-shot' chassis lubrication (you merely press a pedal from the driver's seat, instead of greasing separate points under the car) and there is the pleasure of being able to work on the six-cylinder engine without the need for long and preferably treble-jointed fingers. Even more important, there is the pleasure of driving, with steering and controls that respond directly and precisely.

The bodywork of these Bentleys is usually aluminium, which eliminates that arch-enemy of the motorist, rust, but it must be admitted that wood-rot in the frame is almost impossible to put right if allowed to become too serious!

Another factor is that the sturdy steel frame on which the Bentleys were built, with chassis members of as much as $\frac{3}{16}$ in. thick, makes the passenger compartment much safer in the event of a high-speed crash than those of most modern 'monocoque' design cars, in which the body sections are welded up to form a one-piece shell.

If the gearbox of the '3½' is used to its full advantage, then the performance of this two-ton car on the straight is similar to that of the Mini-Cooper, although the Mini-Cooper has about five brake horse-power per cwt of weight, the Bentley only three. Additionally, the smooth power of the six-cylinder engine means that one rarely needs to change down from top gear, except when moving off. This is a double blessing of course, for the lower gears are 'crash' and not synchromesh!

So, if you are prepared to accept that a Bentley such as the '3½' needs two parking-meter spaces instead of one, then it represents a completely reliable, comfortable and economical means of transport. But don't all rush: there are only a few hundred left. . . .



Four years ago the first ICI Research Associates and Senior Research Associates were appointed to a 'Scientific Ladder'. This enables some outstanding Company scientists to progress in their own line without having to take on the extra managerial duties otherwise required. We now begin a series about the work some of them are doing, and we start with Professor Dennis Dowden, a Senior ICI Research Associate since January 1965. Since his work concerns the principles of catalysis, the title of this interview is

catalysts: agents of change

Photographs: Roger Wood

Editor: **Professor Dowden, could you explain broadly what a catalyst is?**
Dowden: A catalyst is a substance which speeds up chemical reactions without itself undergoing great alteration or appearing among the products of the reaction it causes.

Many important industrial processes, such as ammonia synthesis, vital to Agricultural Division, would not work at all without a catalyst. Catalysis is universal. It occurs in the nuclear reactions of stars and in the processes of living organisms. Enzymes, formed by living cells, cause or speed up chemical reactions in the body and are catalysts; we humans are living assemblies of catalytic systems.

A catalyst is homogeneous, if it is in the same state as the chemicals involved – a catalytic gas for instance added to a gas, or a catalyst dissolved in a liquid. If it is in a different state, such as a solid in a fluid, then it is heterogeneous. Solid catalysts are effective only at their surfaces, so they are formed as collections of minute particles to give the maximum surface area. Unfortunately, the notion that catalysts do not change in use is not really exact. Many headaches occur because catalysts *do* alter with time: they are said to 'die', or when they react with impurities present among chemicals reacting they are 'poisoned'. The exposed area usually decreases in time. However, a good catalyst has a very long life before these effects become important. Catalysts can live as long as six years. Others, where the process can afford the costs, may survive for only three months.
Editor: **How do catalysts work?**
Dowden: By forming compounds with the reacting chemicals and the products of their reaction. The formation and decomposition of these compounds, on the surface of a solid catalyst, provide an easier route from the raw materials to the products. The detailed 'map' of the easy route is not usually known, since it involves the properties of ill-defined compounds and the movements of atoms.

Take the synthesis of ammonia. Ammonia is made from molecular hydrogen, derived from water and petroleum, and nitrogen from the air. Both the nitrogen molecule and the hydrogen molecule contain two atoms each. Rather than use energy to tear the molecules apart in the gas phase, it is easier if the molecules react with an iron surface to give iron-nitrogen and iron-hydrogen compounds, each containing single atoms of nitrogen and hydrogen. Then the nitrogen atoms and the hydrogen atoms combine on the iron surface to give ammonia, which leaves the surface as a gas. There are theories which help a great deal in selecting catalysts and predicting what will happen to them during their life-time, but they do not give enough detail, so we often have to proceed by trial and error methods.
Editor: **What are your main objectives?**
Dowden: First, to develop theories about catalysis which will enable me to understand the experimental facts and to plan experiments to test these theories. Second, to apply the empirical knowledge and the theories to solve ICI's catalytic problems. Third, and perhaps this is the most important, to discover new catalytic processes. Fourth, to teach others the science of catalysis.
Editor: **How do you do your research?**
Dowden: My research spans most of chemistry but excludes (except superficially) biochemistry. The techniques employed are, for instance, those involving X-ray examination of solids, and electron diffraction, together with the methods of solid state chemistry and physics, gas adsorption and kinetics and the whole of descriptive chemistry.

A thorough understanding of the theory of catalysis is essential. A good theory is a directory that enables you to choose your catalysts to some extent. It is an easy reference guide to the empirical facts of catalysis, but it is more than that because it embodies the essence of future discovery. Without it, especially in complex systems such as we meet in catalysis, it becomes very difficult to choose your pathways of research. Although it sounds a little unscientific, you have to know what you are going to find before you can set out to look for it.
Editor: **What governs the decision to use one catalyst rather than another?**
Dowden: Technical practicability – and cost. We cannot use catalytic processes which are uneconomic. We already envisage catalytic systems *technically* superior to those in use, but their cost makes them unusable at the present time; work continues to reduce these costs. Certain catalysts for example, would present very awkward waste disposal problems. Speed is essential: a catalyst should make the reaction go as fast as possible. If we have some very expensive high-pressure equipment we want it to make as much product in a given time as we can. Equally important therefore is selectivity; our catalyst must produce the reaction we want, not one we wish to avoid.
Editor: **Do some catalysts produce more than one reaction? Is this a problem?**
Dowden: Yes, but it can usually be overcome by modifying the original catalyst. A common difficulty is the deposition of, for instance, carbon on the surface of a catalyst, which coats the active surface and reduces activity; it gradually accumulates on the surface from parasitic side-reactions which proceed slowly alongside the main reactions. By designing our catalysts suitably and adding certain 'promoters' or 'beneficial' poisons we can avoid, or at least limit, these reactions.
Editor: **Suppose you had a very cheap main process. Would it then pay to use a more expensive catalyst?**
Dowden: Possibly. When costing a process the catalyst itself has to be looked at only as one factor in the whole. It could be unimportant compared with, say, the special steels needed because of the chemical engineering, which might greatly inflate the capital cost of the plant. A process is rather like a chain, no stronger than its weakest link.
Editor: **What about liaison with the other specialists involved?**
Dowden: There has to be, or there should be, the most intimate dialogue between the chemical engineers, the engineers, the physicists and the chemists – everybody concerned with developing the process. This is because the practice of catalysis covers a great deal of chemistry, involves a great deal of solid-state physics, and is closely concerned with chemical engineering in mass and heat transfer and design.

Here one has to see the expert in a modern light. The old-fashioned idea of the expert, probably never accurate anyway, as a very limited person skilled only in a narrow technique is not at all applicable now. It's not uncommon to find experts knowing more about related sciences than some ordinary practitioners in those areas. In a subject so complex success depends upon this knowledge of other fields.

Catalysis is a very good example of an interdisciplinary subject. Many people who have studied scientific advance point out that progress seems to be more likely in areas *between* accepted disciplines. Catalysis is just such a subject and we can expect astonishing advances in the next ten years.
Editor: **Please outline briefly ICI's own contribution, selecting a few outstanding examples.**
Dowden: First, the production of polythene by the polymerisation of ethylene. This is a homogeneous catalysed reaction, and the contribution to modern living of polymers such as polythene is so great that this catalysis is one of the most important.

More recently, in Agricultural Division's own province, we have the development of the steam-reforming process, now licensed all over the world and, again, a new process we are seeking to license for low or intermediate pressure-synthesis of methyl alcohol. The steam-reforming process has put this country back into business in the production of ammonia. Without it we would have had to rely on our older coal resources and could not have competed in world markets. Another contemporary development of great significance is Heavy Organic Chemicals Division's discovery of the vinyl acetate process, one of the best examples of catalysis in solution in the industrial field. It is interesting because it shows that homogeneous and heterogeneous catalysis are closely related and not quite different in kind.
Editor: **What do you consider is the most difficult part of your work?**
Dowden: Two things rank almost equal. One is the theoretical side, the endeavour to produce bigger and better theories about catalysis. Perhaps the most difficult is the exploratory research: stepping out from the known into the unknown. We do have some guide-lines from empirical knowledge and from theory. But in industry we not only have to make scientific discoveries, we also need new industrial processes.

It's not difficult to obtain new scientific results. It's very difficult to devise new significant theories. It is still more difficult to discover new industrial processes. Undoubtedly the most difficult element is exploratory research. Here one has to rely upon a mixture of fact, theory, and 'intuition', which I prefer to call personal knowledge.
Editor: **What is most rewarding?**
Dowden: Solving the problems. There is also the excitement that we might discover an important major industrial chemical process soon. Without this hope and this excitement I doubt whether we could carry on. Intellectually the most rewarding element is, with time and maturity, to be able to stand back and see the applied science and so-called pure science of chemistry as a whole; to see the laws of science operating even in complex situations where at first sight they don't appear to hold, and where older workers might have thought there was artistry or magic involved. This total awareness I find most rewarding.

Jack O'Neill, a member of Professor Dowden's team at Agricultural Division, uses a gas chromatograph, which analyses gas mixtures with the aid of instruments able to detect the components by their differing electrical and thermal conductivities

Editor: **What is the most surprising thing about catalysts?**
Dowden: The fact that a catalyst can have these effects on the rates of chemical reactions while remaining almost unaffected itself. Perhaps this is why the notion of magic crept in, in the early days. The point is that it is not quite unaffected and it's through this narrow gap that the logical and scientific explanation comes in. We have made big strides. In the last twenty years we have shown that catalysis is just a part of chemistry and that there is not much very peculiar about it; the problems of catalysis are those of chemistry.

It is also intriguing to discover just how universal catalysis is, that life as we know it would be impossible without it.

The surprising thing to a layman is the very dramatic effects which catalysts can have, for example, in inducing rapid combustion or explosion. But catalysts, even in small quantities, greatly reduce the temperatures at which reactions will occur: there are reactions which, in the gas phase without a catalyst, need hundreds of degrees centigrade to make them go at a measurable rate, but with a metallic catalyst they proceed extremely rapidly at 80° absolute (that is minus 193° centigrade) or even lower.

Editor: **What educational qualifications do you hold and how do they help?**

Dowden: My undergraduate and postgraduate days were spent at Bristol University where there was (and still is) a very powerful school in surface chemistry and in solid state physics. I did my early research on solid surfaces both at Bristol and in America. For a long time I studied the relationship between chemisorption and the structure of solids, especially the effects of their electronic structure. This was the most important element of my education.

Left: This pelleting machine at Agricultural Division's Clitheroe Works (where catalysts are made on a very large scale) turns out a ton of catalysts a day for the ICI ammonia process. Operator is John Burnside

Below: Professor Dowden in discussion with Dr Derrick Ashmead

Editor: **Physics and chemistry are both involved in catalysis. What is the role of each?**

Dowden: The beginner needs a good basis in physical chemistry. Later on all is grist to the mill. My early association with the subject was in the late 1930s, a time when the chemistry of solids and of surfaces, and their physics, were coming together. Before that, there had been a descriptive chemistry of solids and an approach from theoretical physics. After the later thirties it becomes almost impossible to distinguish the chemistry, the physical chemistry and the physics of solids, they are so closely inter-related. My own interest and what small success I've had in this area arises from an early juxtaposition of these pieces of science, to give some new information about solid surfaces.

Editor: **What special training have you had, and how does this help you now?**

Dowden: I don't think I have had any explicit training. One's training here is by doing the actual solution of the more complex industrial problems. I myself came into industry as a physical chemist with very little knowledge of chemical engineering. My organic chemistry was extremely rusty. But over the years I have learned a great deal of chemical engineering, organic chemistry and the rest.

Editor: **What special experience have you had?**

Dowden: Apart from the long time in research, I spent about a year and a quarter as a senior plant manager at Clitheroe, our catalyst manufacturing plant. Catalysts are rather complex chemical systems and so their manufacture is also complex. That period at Clitheroe taught me the great difficulties experienced in bringing processes from the test tube to the plant scale, and I came to have a very lively regard for the problems one meets in development. At the same time I was optimistic enough to believe that even these difficult plant problems could be resolved by the proper application of science.

Editor: **As a visiting professor at the Imperial College of Science, what do you do?**

Dowden: I spend between 10 and 15 per cent of my time working as visiting professor in the department of Chemical Engineering and Chemical Technology. In fact, I spend rather more than this because of my own time spent in preparing lectures and I lecture on applied catalysis to second-year chemical engineers. And I also give tutorials – the only way of discovering whether your lectures are going over, and of establishing real contact with the undergraduate. Apart from this I help organise symposia in the department, contribute seminars on various specialised topics and in a small way help with research.

Editor: **Do you enjoy this work?**

Dowden: I was pleasantly surprised to find that I enjoyed teaching applied catalysis. I think this is because it is a new topic in the department and more particularly because I think I have something to contribute. Courses in applied catalysis are rather rare in the universities and technical colleges. At the same time, it is one of the most important aspects of industrial chemistry and therefore really needs teaching.

Editor: **Do students come and see what you're doing?**

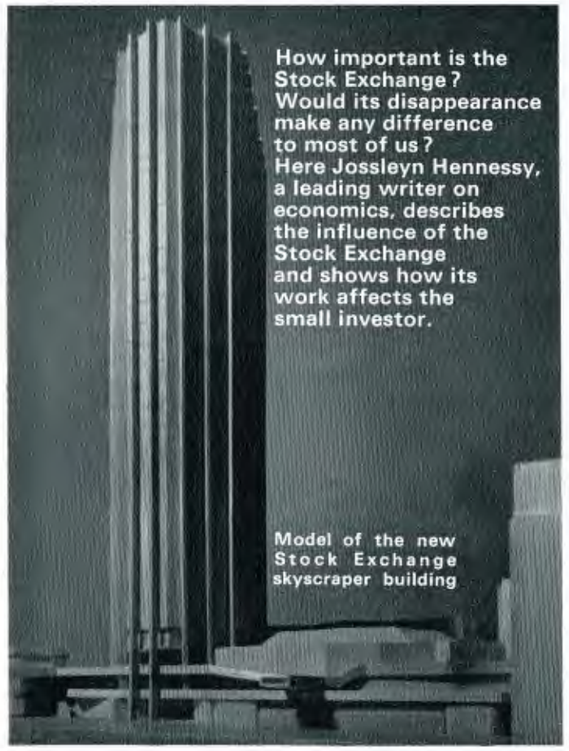
Dowden: Yes, we arrange for staff, students and groups of students (e.g. chemical societies, chemical engineering societies) from various departments to come up and see things which interest them. Not so long ago members of Imperial College Chemical Engineering Society came here to have a look around. The theme was 'Catalysis at the bench and in practice.' We use every possible opportunity for improving the links between industry and the universities at all levels.

Editor: **Any interesting or significant results of your work at Billingham?**

Dowden: My own contribution is the association of catalytic activity with the electronic structure of solids, in the first place for metals, and more recently for semi-conducting solids. Here we have shown that the kind of electronic influences which one finds in ordinary chemistry can also be found in catalysis by solids, and we have delineated some of the patterns of activity, and given them an electronic interpretation. This marks some advance. Latterly I have been even more concerned to show how empirical facts and theories in catalysis can really be used to design catalysts. This is one of my major current interests. You will usually find it stated that catalysts cannot be designed. I think this is wrong, and I'm setting out to show that they can be.

stocks, shares and you

Jossleyn Hennessy



The first function of the Stock Exchange – and not only *the* Stock Exchange in London but also smaller exchanges in some provincial cities – is to mobilise individual savings.

If nobody saves, the standard of living cannot rise. If we all spent all our income on all goods as they were produced, industries could neither expand nor adopt new techniques to provide new products. But savings cannot generate change and growth if kept idle in stockings or banks. They must be passed on to those who will use them to build new factories, introduce new products or provide new services.

Before the London Stock Exchange developed in the mid-seventeenth century (its first building was opened in 1773) the typical business enterprise was the family concern, financing itself out of its own savings. To expand it often had to find outside partners. But few investors want to tie up their savings permanently in a business run by others – and no business can grow if it can be called on at short notice to return money it has borrowed and then spent on plant, equipment, goods or raw materials.

To satisfy the opposite needs of (i) *permanent* capital for enterprise and (ii) cash back *on demand* for the saver, the limited joint stock company was devised, dividing the capital into shares so that individuals could invest small amounts as well as large, and a market was evolved where shares could be bought and sold without delay.

Once a saver has invested in shares in a company, however, their value will rise if it prospers and fall if it does not, so the Stock Exchange's second function is to enable present values to be ascertained. It does this by creating an active market for

The Stock Exchange was often the scene of hectic activity even in the 1870s, as this old print shows

Photographs: Stock Exchange

shares. The greater the number of transactions, the more each is nearer the share's true current value.

The more that governments create conditions which boost the growth of profits, the more savings will be tempted out of barren idleness into fruitful use. On the other hand, measures such as capital gains taxes or corporation taxes and income taxes, or policies such as price freezes which reduce prospects for change, growth and profits, all narrow the market. The shareholder in need of ready cash will then have to accept a lower price for his shares than is economically justifiable.

The Stock Exchange's third function is to ensure that savings available for investment are put to the best use.

Before the shares of any company can be bought and sold in the market, its record and accounts are investigated by the Stock Exchange Council. This is no guarantee to the prospective investor against loss – no one can be certain that a particular enterprise will succeed – but it does show that the company meets the Stock Exchange's high standards of accountancy and published information. And these standards are in fact more stringent than those required by law.

The value of the contribution to the economy made by the Stock Exchange in carrying out its three main functions is not a matter of guesswork. Investors have the choice of almost 10,000 quoted securities – the term covers shares and other forms of investment – with a total value today of no less than £80,000 million, although this of course varies according to prospects at home and abroad.

These securities range over all sorts of enterprises, including insurance, motors, aircraft, newspapers, paper, printing, property, teas, tobacco, mines, rubber, banks, wines, spirits and building. Others in the list include drapery and stores, chemicals, cinemas, theatres, television, engineering, metals and electricals. These and other enterprises, carried on with capital supplied by shares owned by the public, account for as much as four-fifths of British industry and trade.

Most of us – an estimated five out of every seven adults in Britain – have helped to provide some of this capital, as indirect investors. If you have money in a bank, a building society or a pension fund, if you hold life insurance policies or pay trade union contributions, then indirectly you have invested on the Stock Exchange, for all these organisations invest a large part of their funds – including your payments and contributions – through the Stock Exchange.

But what if you want to join the two-and-a-half million people who are also individual investors? How does the Stock Exchange help if you want to put your own savings to work through some of those 10,000 or so quoted securities?

One way to invest is by making use of the specialists working for insurance companies, unit trusts and investment trusts, all of which collect small amounts from millions of savers and pool their risks over wide selections of shares. They are experts in assessing the worth of industries and individual companies, both at home and abroad. The need for experience in investment, plus the cost of buying or selling shares in small amounts, mean that the best way for a small investor to accumulate capital is in fact to leave the choice of shares to the managers of insurance and trust funds. (An investment of £1 a week in a well-known unit trust, with income reinvested over the past 25 years, is worth £8,000 today, although total payments would only have been £1,300).

The second way to invest, which many advisers say should only be tried when you have accumulated minimum savings of, say, £1,000 to £1,500, is to venture your *additional* savings

Exterior view showing oldest entrance to the present building

Members and clerks check prices and dealings on the floor of the Stock Exchange. Details are entered in 'Bargain Books'

in direct investment. You get in touch with a stockbroker (a list of brokers is available from the Public Relations Officer, Stock Exchange, London) and if he is to give you good advice you must give him full information about your family commitments and financial resources. If safety of capital is your first consideration, expect a smaller income. If you want more income, you must invest in an enterprise where the uncertainties are greater. Or you may prefer to invest in a growing business in which your holding may increase in value over the years.

Buyers of shares are like the buyers of anything else. Some are ready to pay more for top-quality goods. Others shop around for 'bargains'. Prices of shares vary with their quality and 'quality' in shares means present profits and future prospects. The Stock Exchange exists to assess these.

Suppose that in the same industry there are two companies, identical except that United Products has cheaper power supplies, so that it earns 25 per cent more than its competitor, Associated Products. Suppose that A.P. pays five per cent and U.P. pays six and a quarter per cent on shares originally issued at 20s each. If the shares of the less profitable A.P. are currently quoted at 20s, those of U.P. will be 25 per cent higher, at 25s. At those prices a buyer gets the same return on his money, since A.P. pays five per cent on a share costing 20s. to buy and U.P. pays 6¼ per cent on a share costing 25s.

If, however, a number of U.P. shareholders want to sell, to spend the cash or re-invest elsewhere, the price of U.P. might fall to 24s. They would look cheaper, while A.P. would look dearer. Investors would buy U.P. and sell A.P. until equilibrium was restored. There is thus a natural equilibrium of prices and, in free and active markets, prices are shaded up and down, hour by hour, to maintain 'true' values.

A company's ability to raise new capital, and the cost to it of doing so, depend on the estimates that savers (mostly acting on the advice of brokers or other experts) make of its prospects compared with those of other companies. The criteria are the price at which the new share is offered – and its relative yield, actual or prospective, compared with others in the market. The cost to the company of raising new capital is not the price at which it sells its new shares but the rate of interest which investors hope to get on the savings they invest.

In a free and active market, the differences between yields reflect the merits of the various enterprises. Firms with respected managements and good prospects borrow cheaply and can therefore afford to raise all the money they want. Others may find the cost prohibitively high. Thus the Stock Exchange grades the good and less good, and rejects the bad.

The bigger, freer and more active the market, the more efficiently savings can be allocated. In narrow markets, as sometimes happens overseas where government regulations or other factors reduce the number and variety of opportunities for investment, constant shading of prices is impossible. Prices jump up and down, so that investors tend to pay too much when buying and to get too little when selling. Good or bad news causes disproportionate rises or falls, the relative prices of shares cease to be 'true' values, savings are inefficiently allocated. The standard of living suffers.

The Stock Exchange 'makes a market' in each of the securities it deals in. At times of uncertainty – threat of war, a general election, a budget speech – sellers may outnumber buyers. If sellers were not discouraged, buyers encouraged, the market would come to a standstill. Investors would find their savings locked up indefinitely. The division of the Stock Exchange into brokers and jobbers ensures that prices in London remain relatively stable. How does this system, which is unlike that in any other country, work so effectively?

Suppose that after talking to your broker you decide to buy 50 of the £1 Ordinary shares of 'Abstract Products Ltd'. Your broker goes to the floor of the Stock Exchange, to that part of the market in which these shares are traded. Every type of security has its allotted space – the 'Gilt Edged' market for Government Stock, the 'Oil' market, the 'Foreign' market, the 'Mining' market, and so on. Here your broker meets the jobbers, specialists in the shares of a particular market. It is the competition between jobbers for your broker's orders which secures you the best price possible. Unlike brokers, who as agents for their clients work on commission, jobbers operate as wholesalers. Their livelihood depends on the net result of all their transactions.

Your broker approaches a jobber dealing in 'Abstract Products' and, without revealing whether he wishes to buy or sell, asks the price. The jobber quotes, say, 31s. 3d.–31s. 6d., meaning that he will buy at 31s. 3d. and sell at 31s. 6d. Your broker asks other jobbers for their prices, hoping to buy your shares more cheaply. Perhaps he finds a jobber more anxious to sell than to buy, who is quoting 31s. 1½d.–31s. 4½d. Having checked that he cannot buy any cheaper, the broker buys your 50 'Abstract Products' at 31s. 4½d. a share. For his services he charges 3d. in the £1 commission. As the cost of your 50 shares is £78 8s. 9d. his charge would be £1 which is the minimum and applies to all transactions of less than £100.

But the jobber has also rendered you a service. If there are more sellers than buyers of 'Abstract Products,' the jobber, by absorbing the shares, steadies the fall in price. But his capacity to buy is limited, so that by lowering his buying price he discourages sellers and encourages buyers to emerge.

If 'Abstract Products' are rising, and one broker after another proves to be a buyer, the jobber may find that he has sold more than he has available, so to discourage buyers he raises his selling price. But other jobbers, taken unawares by the sudden interest in 'Abstracts', may also have sold more than they hold. Each will be anxious to 'level his book' before the rise in prices involves him in a loss, so they compete keenly to attract sellers.

If there were rumours that, say, 'Abstract Products' was about to go bankrupt, jobbers could not halt the downward trend of its price. Nor if the news were good could they stop it rising. Their role is to iron out short-term fluctuations.

Without jobbers, prices would depend absolutely on the daily balance between buying and selling. Prices of shares now regarded as stable – like ICI – would often fall steeply one day and soar to the skies the next. Such see-sawing makes savers reluctant to invest in shares, so that in mercurial markets the nation's savings are inadequately mobilised and inefficiently allocated. This is something the country cannot afford. Twenty per cent of all brokers' orders are for amounts of £100 or less. As the number of exceptionally wealthy individual investors tends to fall, the need to mobilise more small savings grows in importance.

It is impossible to say how many of the companies whose shares are 'quoted' would have come into existence without the Stock Exchange – but it *is* certain that without it 80 per cent of our present day industry and commerce would not be adequately financed, factories would not be built, tools would not be provided for the people who work in them, there would be fewer jobs and living standards would fall.

the year 2000

Trevor I. Williams

In industry, success favours those who sense the coming of new demands or the passing of old ones. It also favours those who are first to see better ways of doing what we are doing now. The great industrialists of previous generations were those who anticipated the trend of events. Lately, however, the whole question of long-term forecasting has been tackled more seriously and systematically, by governments and industry, for three main reasons.

First, the tempo of change is everywhere greater than ever. Second, most major innovations now demand such heavy capital investment and long development before any return can be seen that the cost of misjudgment is very high. General industrial experience – and certainly our own in ICI – is that there may be up to ten years between a new discovery and the first significant commercial return. Any new product to which we seriously commit ourselves now must be right not for today, but for the late 1970s and early 1980s. Finally, computers for the first time make it feasible to analyse the vast amount of data inseparable from long-term prediction.

ICI and other large industrial corporations engaged in this new activity of long-term forecasting are concerned not so much with their own domestic issues but with the sort of world they will operate in – a world they are powerful enough to influence. This raises a whole series of complex questions and the answers have to be looked for not only in scientific and technological developments, but in their interplay with politics, economics, sociology, religion and other powerful factors. What, for example, will be the real force of the population explosion? Will it double the world's population by the end of the century or will it be tempered by widespread adoption of effective methods of birth control? Unless all calculations are upset by a world war, a very large rise in population must be expected, so how are the extra millions to be fed?

Can conventional agricultural methods, backed by much more intensive use of fertilizers, more mechanisation, greater use of pesticides and herbicides, produce enough food for all? Or is there a predictable deficit, so that we have to look seriously at the possibility of synthetic or semi-synthetic foodstuffs? Again, how will the leading nations be aligned politically and economically in the next 30 years? The importance of this for overseas investment needs no emphasis.

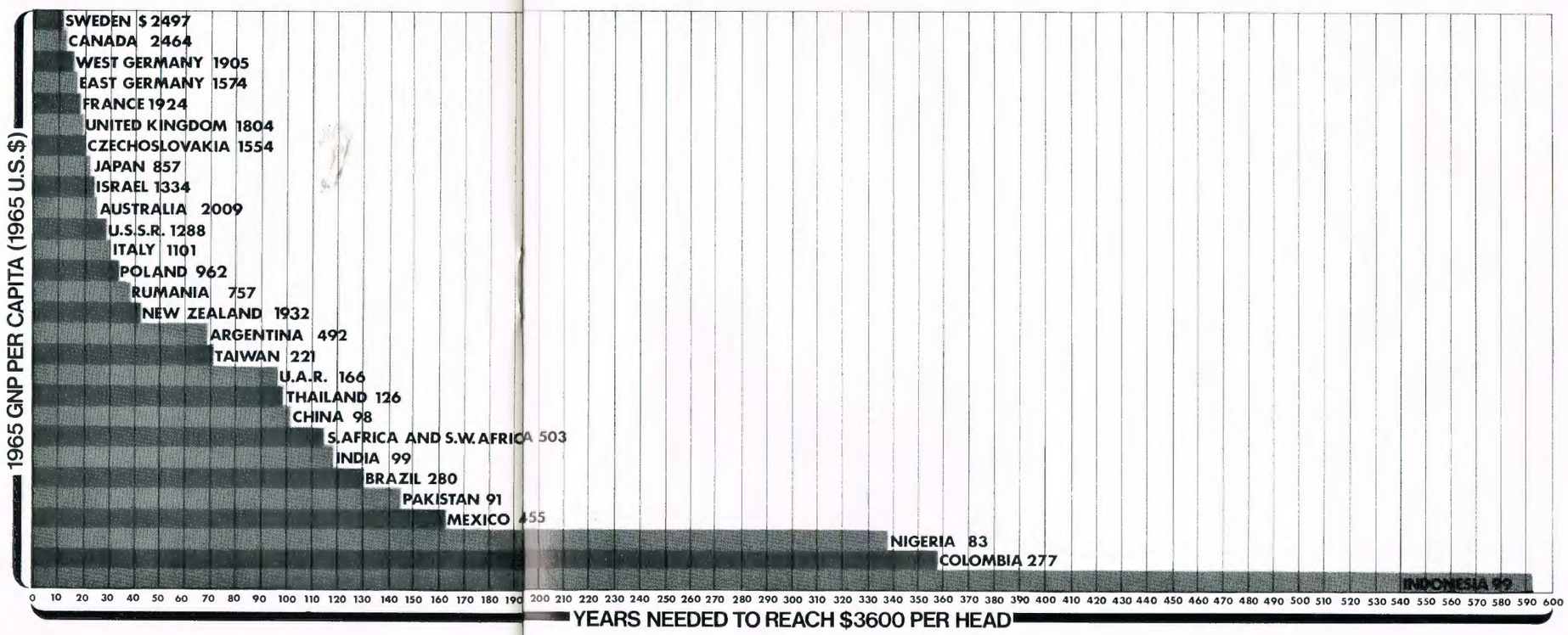
Not unnaturally, most of these studies tend to take A.D. 2000 as their end point. It is, of course, something of a magic number, the start of a new millennium in human history. But it is also a fairly realistic date, going no further into the future than the early 1930s – which seem not so distant to many of us – take us back into the past. It is a date which about two-thirds of the people now living will see arrive. Many of those who will then be controlling the Company are already taking important educational decisions which will profoundly influence their careers.

This date also provides the title of a newly-published American book*, sub-titled 'A framework for speculation on the next 33 years'. Its appearance emphasises the widespread interest in forecasting. The first publication of the Commission of the Year 2000, which is sponsored by the American Academy of Arts and Sciences and supported by the Corning Glass Foundation and the Carnegie Corporation, it is the product of the Hudson Institute, a non-profit research centre which studies major problems affecting US public policy.

The book is not light reading of the fanciful, science-fiction type, but a highly-professional approach to the developing technique of long-range forecasting, with some predictions on how world events may move later this century. It is wholly American in its approach, for this is the remit of the Hudson Institute. It is also characteristic of modern American scholarship: thorough, objective, and deadly serious.

For the student, the book provides a wealth of useful information in the form of economic growth curves for the leading nations, as well as population changes since 8000 BC; gross national product tables; income distribution patterns; and gross hourly earnings in selected industries. Shown below is a graph adapted from the book which indicates how long various countries will take to equal the average income per head in the USA in 1965 – $3600. Anyone looking for dogmatic prediction will be disappointed, for this is a statistical art based on assessing the relative probabilities of successive stages in a developing situation.

There is, for example, an extremely interesting 'scenario', as it is called, which describes the possible results of an unsuccessful US invasion of North Vietnam. Other speculative scenarios indicate how a run of wrong policy decisions might reduce the USA to a second- or a third-rate power by 1985.



Future progress can be looked at as a journey along a road which constantly divides. If at each division we take the predicted route we shall reach the predicted destination in the end; if instead we are repeatedly perverse and do the unexpected then we shall end up further and further away from the expected arrival point. The road to 2000 AD is fraught with uncertainty – the more so, the further we try to see our way along it – but this does not mean that there are not useful lessons to be learnt in trying to trace it.

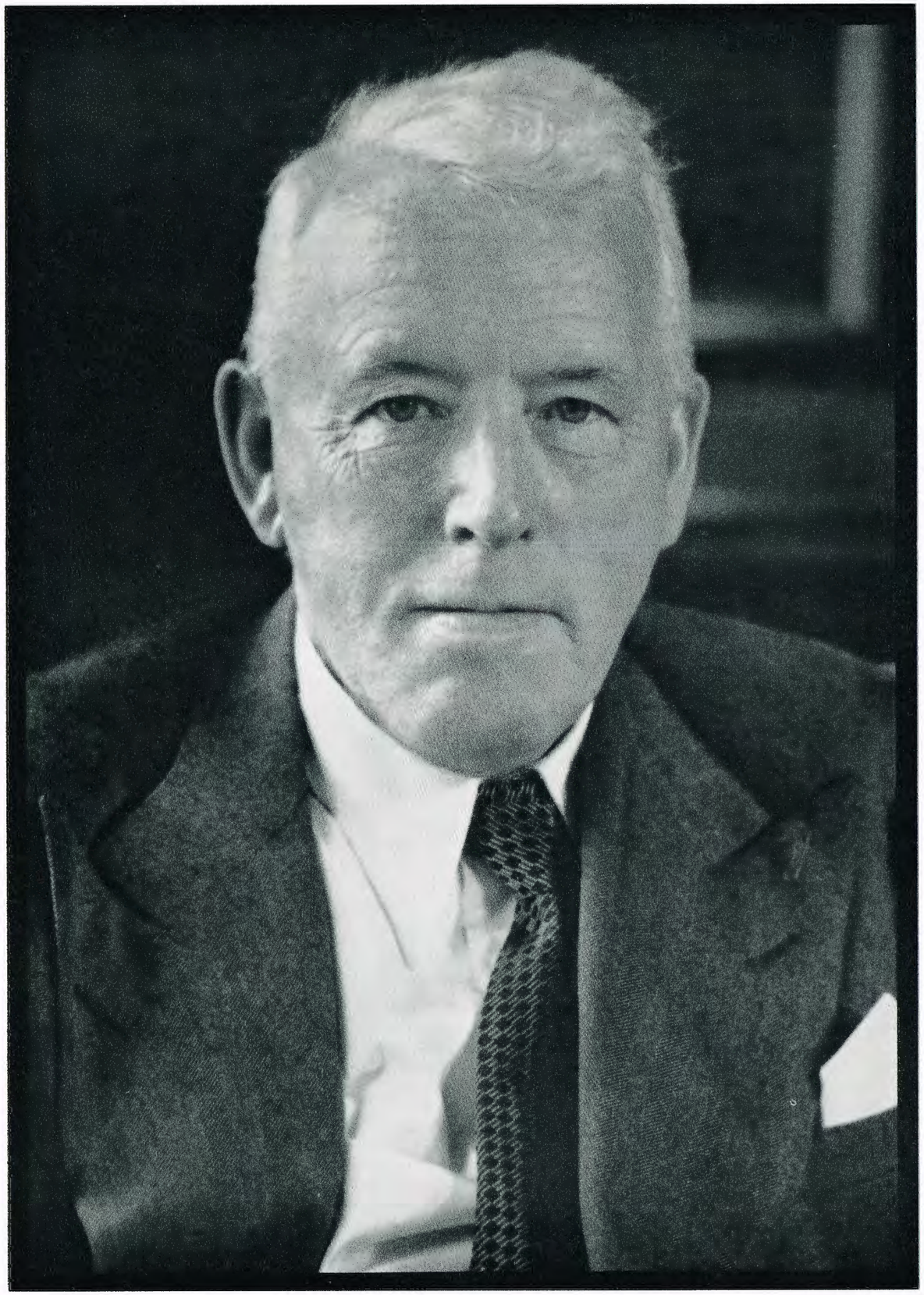
On some of the big world issues this book is disappointingly silent. Nor do the authors seem conscious enough of the profound social results of technological innovation. After all, many older people have in their lifetimes had to adapt to such far-reaching innovations as electricity; the telephone, radio and television; the bicycle and the motor-car; flying; the consequences of the atom-bomb and of man's first venture into space. Surprisingly, this book includes almost nothing on food, perhaps the most basic issue of all. On the other hand, there is an excellent forecast on the future link-up of vast urban areas in the USA, with Boston perhaps joined to Washington and San Francisco to San Diego. But what will be the transport system of such an enormous sprawl? Will the internal combustion engine, with its exhaust fumes, be tolerable? Or does the future lie with electrically-driven vehicles and, if so, what will be their power-source? These questions deserve more attention than they get – but perhaps the balance will be put right in later volumes.

The publishers claim that *The Year 2000* 'ultimately defends the humanist position of man as architect of his own destiny' and that 'questions of progress in technology and progress in planning and control of population growth, food supply, aggression, internal alienation and disruption of our own society, economic co-operation and the rise of new nationalism are all related to the larger design of building a world in which life is more than merely livable.' Your reviewer happened on this dust-jacket claim only after reading the book, and it came as something of a surprise; this high moral message had not reached him, but other readers might be more perceptive. Thoughts of a planned Utopia have buoyed mankind up for centuries and if in fact it can be achieved then we are that much nearer to it. Many, however, would settle for far less. If 'think-tank' techniques can help to make our long-term planning more rational, so enabling us to avoid the worst perils as the current rushes us along, they will make a valuable contribution. If eventually they do more, so much the better.

ICI, through the Research and Development department at Head Office, has been deeply involved in long-range forecast studies similar to those described in the book reviewed here – but with a special emphasis on factors likely to endanger or to encourage the Company's future growth as a major science-based technological corporation of world dimensions. We seem to be moving into a phase in which ever larger and more powerful technological companies will be operating in world markets, providing still more intensive competition to ICI. Concentration on the real strengths of the Company and their optimum development will be needed in the future even more than in the past. One of these strengths is a vigorous and effective research and development organisation, to maintain our existing processes and products at levels second to none and to produce far-reaching innovations of benefit to society.

Associated studies carried out with the Divisions have already pointed the way to several promising opportunities for innovation and have begun to influence that part of ICI's research and development effort which is planned to take us into new areas of business. One such example is the recently-publicised work (now at an early stage in Agricultural Division) on the synthesis from natural gas of proteins for foodstuffs. During the next five or ten years, other results are likely to be announced.

***The Year 2000: A Framework for Speculation on the Next Thirty-three years,** by Herman Kahn and Anthony J. Wiener, with an introduction by Daniel Bell. The Macmillan Company, New York; Collier-Macmillan Ltd., London. 63s.



LORD FLECK

KBE, DSc, LL.D., FRS

Lord Fleck, Chairman of ICI from 1953 until he retired in February 1960, died in Westminster Hospital, London, on 6th August. Born in Glasgow in 1889, Alexander Fleck started his working life as a 'lab boy' at Glasgow University, where later he gained a chemistry degree at the age of 22 and an appointment on the University's teaching staff. By 1913 he had his own research laboratory as physical chemist to the Glasgow and West of Scotland Radium Committee, where his work was concerned with radiological research on cancer.

Lord Fleck, as he was to become in 1961, moved into industry in 1917, when he joined the Castner-Kellner Alkali Company Ltd., which later became part of ICI. He was manager of their Wallsend works in Northumberland from 1919 until 1927, when he moved to Billingham-on-Tees. In 1931 he became managing director of the then General Chemicals Division and from 1937 to 1945 he was chairman of what is now Agricultural Division. He joined the ICI Board in 1944, became a deputy chairman in 1951 and was chairman from June 1953.

Lord Fleck's contributions to science as well as to industry have been widely recognised. In 1953 he received an honorary LL.D. from Glasgow University and later honorary degrees were conferred upon him by the universities of Oxford, Durham, London, Nottingham and Dublin. He was also an Honorary Fellow of the Manchester College of Science and Technology. His scientific work received further recognition when in 1955 he was elected a Fellow of the Royal Society, and in 1957 he was elected an Honorary Fellow of the Royal Society of Edinburgh, a distinction limited to only 22 members of the British Commonwealth who have made notable contributions to science or literature. In 1958 Lord Fleck was president of the British Association for the Advancement of Science. He was a trustee of the new Churchill College, Cambridge, and he was a past president of the Society of Chemical Industry.

Lord Fleck was chairman of the advisory committee invited in 1953 by the National Coal Board to review the organisation of the coal industry, and following publication in 1955 of the committee's report he received the KBE for 'services to the Ministry of Fuel and Power.' Other Government-appointed committees of which he was chairman included one set up in the later 1950s to inquire into the British fishing industry, the Scientific Advisory Committee set up in 1958 by the Minister of Power, and the Nuclear Safety Advisory Committee formed in 1960. In December 1960, Lord Fleck was elected Treasurer of the Royal Society, of which he later became a vice-president. He was also President of the Royal Institution.

Lord Fleck was awarded a Barony in the New Year Honours List, 1961, and took the title of Lord Fleck, of Saltcoats. He had continued to be a familiar figure at Millbank since his retirement in 1960. Much of his work for the Royal Society and other organisations was done from an office in Thames House, which he visited for the last time only a few weeks before his death.

Sir Peter Allen, ICI Chairman, writes:

Lord Fleck's achievements and reputation as a scientist and as an industrialist are already well known and, now that he has died after a long, full and rewarding life, his record will be recalled and written about by others. I would like to pay a particular tribute to Dr. Fleck, as so many of us in ICI remember him, as a person, a colleague and friend.

He was from the first, and remained an unassuming, almost shy person who was invariably courteous and approachable, though with a good sense of humour and an engaging sense of the ridiculous. Wherever he went in the Company – as a plant manager in his early days or as Chairman in his sixties – he was respected for his ability and quietly firm leadership, but above all, warmly regarded for his interest in people and what they were doing, and for his kindness.

From his first days in the Castner-Kellner Alkali Co. in 1917, he made his presence felt in the works both as a chemist and as a person. He had great curiosity and a belief in seeing and trying things for himself – attributes which never left him. His early assignments in ICI, at a time when the post-war period was marked by restiveness and uncertainty in the factories, were not easy ones. Because of his ability to mix with men, his readiness to discuss problems with them without any suggestion of talking-down, and above all his fairness and freedom from all prejudices, he was able rapidly to win respect and to ensure harmony and goodwill in the works. It was characteristic of him that he always set an example, whether by undertaking the work of an ordinary processman for a spell in order himself to experience the requirements of the job, or by visiting his men on a Sunday when he could have been resting.

As he rose in the Company these characteristics and strengths endured, and their influence was more widely and strongly felt. He never ceased to be a scientist at heart and in his approach to every problem, but never neglected the human side. As he said:

'It is not good enough for a plant manager to think that he is doing his whole job if he looks after the plant as long as the labour officer deals with the processmen. It is equally unsatisfactory for the non-scientist to assume that management is so much an art that the value of systematic study on scientific lines can be ignored. The two outlooks must be balanced by mutual understanding.'

Alex Fleck practised what he preached and, when handling difficult problems – scientific or commercial, within ICI or on the frequent occasions on which he gave public service – he never failed to bring to bear his understanding and feeling for people, and their problems and aspirations, as well as his logical mind. On becoming ICI's Chairman, he was not a distant figure-head: rather, he was and was seen to be, the father of a very large family, and a wise and good-tempered father at that. He was seen best in this role at the twice-yearly meetings of ICI's Central Council, when he presided over a gathering of some five hundred representatives of the employees with firmness yet with a geniality and understanding which evoked the best from those at it.

His contribution to the well-being and progress of ICI during his years as Chairman helped markedly to lay the firm foundations on which ICI has successfully continued to build. His colleagues on the Board and thousands of others in ICI will always hold him in great affection, and will remember with gratitude his energy and deep interest in their well-being.

This tribute first appeared in The Times *on 9th August.*

people·projects·products

Division's 'thank you' to employees

Lord Leverhulme, Lord Lieutenant of the County of Chester, presents the Queen's Award to Mr. Hoare, Division Chairman

From 1st October 'Ernie' will loom large in the thoughts of many members of Pharmaceuticals Division. On that date Premium Bonds, acquired with vouchers presented to mark the Division's hat-trick of Queen's Awards, will go into Ernie's monthly draw. The vouchers – value £1 – were handed over on 3rd July, the day of the official presentation of the Queen's Award, to everyone employed continuously by the Pharmaceuticals Division since 1st January 1967.

Speaking at the special celebration luncheon, Mr. R. Hoare, Division Chairman, said: 'To have won the Queen's Award at all is a great thing. But to have won it three times in succession is a very much greater thing. Few companies in the whole country have so far achieved this, and we are the only company in our own industry to have scored the hat-trick.'

Pharmaceuticals Division is the only Division to be mentioned in all three ICI awards.

Cost-cutting idea earns ICI employee £1000

A 48-year-old employee of HOC Division, Mr. Philip Grant (photographed above), returned from holiday recently to learn that he had been awarded £1000 – one of the largest awards ever made under the ICI Suggestion Scheme – for discovering a way of improving the efficiency of the process on which he works. Mr. Grant, an acting assistant foreman on HOC Division's Oil Works at Billingham, works on a plant manufacturing plasticiser alcohols, which are exported all over the world in the face of foreign competition. These alcohols are an essential component of one of the most widely used plastic materials, polyvinyl chloride (PVC).

Other employees who have received substantial awards under the Suggestion Scheme recently include Mr. Walter Webster, a storeman at ICI Fibres Doncaster Works (£945); Mr. Stanley Jowett, a fibres process service operator on Terylene Works, Wilton (£500); Mr. Harry Murray, an additives operator on Terylene Works (£480); Mr. Eric Davies, who works in the Spinning Section at ICI Fibres' Pontypool Works (£375); Mr. Neil Berwick, Mr. Sam Green and Mr. Patrick O'Neill, all of Plastics Division's Teesside Works and Mr. Edmund Cook, Terylene Works, Wilton (£300 each); and Mr. Bob Cunningham, employed in the Engineering Works Fabrication Section at Agricultural Division (£250).

£15,000 plant model flown to USA

Eleven crates containing sections of a precious £15,000 plant model built at Plastics Division headquarters at Welwyn were recently flown to America. ICI America Inc. will use the model to construct their new 'Fluon' plant at Bayonne, New Jersey. Construction work on the multi-million dollar plant has already started and it is expected to be on stream by mid-1969.

More than sixty people have worked on the design project at Welwyn since it began over a year ago. Ideas from four departments – Engineering, Research, Technical Planning and Production – are built into the plant designed by the team of engineers pictured with the model. (To protect ICI know-how in a highly-competitive business, the model cannot be shown in full.)

During the past year there has been a massive exchange of technical and commercial information across the Atlantic between Plastics Division headquarters and ICI America, and the 'Fluon' sales force in America has been increased to build up a thriving market ready for the time when production begins at Bayonne.

Last year Plastics Division received the Queen's Award to industry for development work on 'Fluon', which most readers will know from its use for 'non-stick' saucepans and frying-pans.

New Division chairman

On 1st October Dr. Ernest Brookman, former joint managing director of Paints Division, takes over as the new chairman of Nobel Division. He succeeds Dr. Adam Lees, Division chairman since July 1966, who is retiring.

A graduate of London University, Dr. Brookman joined the research staff of the Plastics Group at Billingham, in 1939, after postgraduate research at Cambridge. He was appointed to the Technical Service and Development Department of the newly-formed Plastics Division in 1943 and became manager of that Division's works at Hillhouse in 1945. After some years as manager of the Plastics Division Technical Department he moved to Paints Division as Development Director in 1958. After a period of secondment as head of Research and Development Department at Millbank from 1962, Dr. Brookman returned to Paints Division in 1964 to become joint managing director.

Film festival award

The first production by Millbank Films Ltd. for an outside sponsor has had the distinction of gaining a silver award at the British Industrial and Scientific Film Festival for 1968. The film, *Ogden versus Bell*, made for the Medical Defence Union, tells the story of a G.P. who is sued by the father of a child for whom he had failed to diagnose an aspiration pneumonia caused by an inhaled foreign body. It shows how the Medical Defence Union works – something which the MDU admit is known to very few of their 60,000 members. Most of the action takes place in court, and it was necessary to build a reconstruction of a Queen's Bench courtroom (below), a set so large that at Head Office only the gymnasium in the basement of Imperial Chemical House could accommodate it.

As a result of its success in London, *Ogden versus Bell* is being shown at the International Industrial and Scientific Film Festival being held in Vienna in September.

ICI scientist to head US Mass Spectroscopy Centre

Dr. John Beynon, an associate research manager of Dyestuffs Division, has been invited to take over the National Mass Spectroscopy Centre at Purdue University in Indiana – one of the largest universities in the USA.

ICI is seconding Dr. Beynon to Purdue for a year so that he can organise the project. He takes up his appointment as Director of the Centre and Professor of Chemistry in January.

As a specialist in mass spectroscopy for 20 years, John Beynon has a world-wide reputation. He has lectured to learned societies and professional bodies in all parts of the world, and has chaired international meetings on this subject in the USA, Germany, France, Holland, Belgium, Japan and Austria. A graduate of the University College of Swansea with 1st class honours in physics, he also holds a D.Sc. from the University of Wales. He joined Dyestuffs Division in 1947, and was seconded to AEI Ltd. in 1955 to help commission a double-focussing mass spectrometer, built to his design, for use in identifying organic compounds. He returned to Dyestuffs Division in 1956 to take charge of spectroscopy. In 1962 he was appointed associate research manager of physical chemistry and, two years later, he became an ICI senior research associate under the company's 'scientific ladder' scheme.

Miner's pigeon wins 'classic' race

When Philippa, a pigeon owned by an Agricultural Division miner, won the recent 600-mile cross-Channel race of the Up North Combine – the world's largest racing pigeon organisation – in record time, her value rose to £500. The miner, Mr. Bill Orley, a caterpillar driver in the Anhydrite Mine, has been with the Company for nine years. He and his son have their pigeon lofts at his Hartlepool home and belong to the Hartlepool Brierton Club.

The bird that has won them recognition throughout the North is a four-year-old blue pied hen. She covered the 548 miles from Bourges in France to Hartlepool in 10 hours 42 minutes, at an average speed of nearly 60 miles an hour.

Mr. Bill Towers, secretary of the Up North Combine and a foreman with Agricultural Division, commenting on the race, said: 'Bill's bird won by 83 yards a minute and this is a wonderful feat in an entry of nearly 5000 birds. It is the first time anyone in ICI has won this race. I have been trying to do it for nearly 40 years.'

Brothers' service record

Two brothers employed at ICI America's Cincinnati works, William and Clifford Conover, each received awards for forty years' service with the Company in July. The event was a first, both for ICI America and for ICI as a whole. World-wide, the ICI Group has over 150,000 employees and as far as we know never before have two brothers celebrated such an anniversary together.

In the photograph (right) Mr. W. B. Duncan, president of ICI America, discusses the event with William (left) and Clifford (right).

Both brothers work in the Fatty Acid Department at Cincinnati works – William Conover is a warehouseman and Clifford a chemical operator – and both are married with families. William has five children, including twins and Clifford has one son, who also worked at Cincinnati factory for a short while, and two grandchildren.

Obituary
Mr. J. C. Swallow

Mr. John Swallow, chairman of Plastics Division for 11 years until his retirement in December 1962, died in a London hospital on 20th July. He was 65.

One of the most distinguished figures in British plastics, Mr. Swallow moved to Hertfordshire from Cheshire during the last war to become research director of the newly-formed Plastics Division. He had previously been assistant research manager of the then Alkali Division at Northwich, where polythene was first discovered and developed in the 1930s. He moved up from research director to managing director and then chairman of Plastics Division, from which post he retired in 1962.

From 1957 to 1959 Mr. Swallow was president of the Plastics Institute and in 1962 he received the Swinburne Gold Medal, an international award for outstanding contributions in plastics.

Mr. E. G. Williams, chairman of Plastics Division, writes:

As one who was for very many years a colleague and close personal friend, I shall miss John Swallow's companionship and counsel very much.

ICI as a whole, and Plastics Division in particular, owe him a tremendous debt, for it was he who was largely responsible for ICI undertaking the original high pressure research programme which led to the discovery of polythene. When the discovery was made, he was the first to recognise its true significance, and he pushed through the intensive programme of research and development which led to the completion of the first commercial plant just before the war.

From the moment polythene was discovered, he developed a very great interest in the whole field of polymer chemistry, which lasted right up to his death. He quickly established an international reputation, and was recognised as the leading scientific figure in the British plastics industry.

During his eleven years as chairman he skilfully guided the Plastics Division through the difficult period of its adolescence. Personnel numbers doubled from 4000 to 8000, output increased seven-fold, and when he retired the Division's future strength and prosperity had been firmly established.

As one who served under him continuously in one capacity or another from the time I joined the Company in 1934 until his retirement, I should like to pay particular tribute to his leadership and to the kindness, warmth and charm of his personality. He was always accessible to everyone, and liked to talk over ideas and problems with all and sundry. As a result, John made a very great number of friends in the Division at all levels, and on behalf of all of them I extend the deepest sympathy to Mrs. Swallow and her family.

people in print

Ian Gordon is a member of the Mond Division Publicity and Information Services Department at Runcorn, and has edited the Division newspaper *Mond Mail* since it began. He joined the Company from the *Daily Mail* 13 years ago, having previously worked as a journalist on provincial newspapers in the North of England. He divides his spare time between trying to create a garden out of a wilderness, learning foreign languages, assisting the local Scout Movement in publicity matters, and occasionally trying to play golf.

Anthony Saunders is a member of Plastics Division's Technical Service Department. He joined ICI in 1964 from Christ Church, Oxford, where he read engineering. At Oxford he took up rowing, winning several events including the University Sculls, was in a Head of the River crew and also rowed for 'Isis'. Since working at Welwyn he has had to give up rowing and now spends most of his spare time working on his old Bentley.

Peter Skelton read Oriental Studies at Oxford University. He joined ICI on graduating but was given a year's leave of absence to teach in Saudi Arabia. On his return he joined Agricultural Division at Billingham and spent two years in the Building Products Marketing Department before moving to Birmingham Sales Office earlier this year.

Trevor Williams joined ICI in 1945 after a period of research in the Sir William Dunn School of Pathology, Oxford. He is editor of *Endeavour* and is also responsible for university matters relating to the Company as a whole. As a member of Head Office Research and Development Department he has been concerned with ICI's own long-range forecasting. Is keenly interested in the history of science and technology. Was a joint editor of ICI's five-volume *History of Technology* (1954-8) and with T. K. Derry wrote *A Short History of Technology* (1960).

the picture makers

Ian Gordon

It all began in a wooden hut in Runcorn – a small display of photographs and paintings to provide encouragement for the amateur photographers and artists among the staff of the Chief Engineer's Department of the then General Chemicals Division.
In the fourteen years since that modest beginning, interest in the Mond Division Annual Art and Photographic Exhibition has spread to other parts of the Company. This year, the first entries from overseas were received – two colour transparencies which earned commendation for a woman member of ICI (Holland)'s staff at Rozenburg.
There are open and limited classes for colour and monochrome photographs and the organisers hope to revive the section for cine films next year if enough entries are received.
So far the Art section has been non-competitive but there is now talk of awarding points to admit an element of competition on an inter-Division basis.
Each year the exhibition, now held in Mond Division's Runcorn Heath headquarters, brings to light something of the patient efforts of the picture makers. Here are some of them with their work.

GEORGE WILKINSON is a member of Pharmaceuticals Division's analytical research staff at Macclesfield. His print, 'Tranquillity,' won the J. V. S. Glass Trophy in the open class for colour prints.

'We were on holiday in Norfolk when I took this picture at Blakeney Quay with a Minolta Autocord twin-lens reflex. I liked the broad sweep of the river and the calm serenity of the boats. The shape of the wooden bollard on the right gave me an interesting frame.'

Taking colour photographs is only a small part of Mr. Wilkinson's hobby. In a converted coalhouse at the side of his bungalow overlooking the Cheshire hills at Bollington, near Macclesfield, he has equipped himself with full colour-processing equipment. Here he works with meticulous care, taking test strips and changing filters in the enlarger to improve the colour effect to his satisfaction.

'I usually spend two evenings in preparation before producing a colour print.'

BILL WILSON is a member of the Production Department of Mond's General Chemicals Group at Runcorn Heath headquarters. His picture 'Oast Houses', a reflection in water, won him the Mrs. J. C. Brown Trophy for colour transparencies.

'This converted oast house dwelling with its reflection caught my eye about five miles from Yalding during a visit to Plant Protection a couple of years ago.'

Dr. Wilson's interest in photography began in his university days. Then he was primarily concerned with its application to scientific work. Nowadays he devotes his spare time to picture-making in colour.

'I like to produce something that is satisfying aesthetically rather than a simple record of a place or a person. I try for a semi-abstract effect. This reflection of the oast houses just gets away from reality that little bit.'

Some of his most striking effects he achieves by copying superimposed transparencies on a home-made duplicating assembly. His work has been accepted in the Royal Photographic Society's annual exhibition.

TED SWARMAN, an instrument project engineer in the Petrochemical and Polymer Laboratory at Runcorn, won the E.J. Stephens Trophy in the open class for monochrome prints with 'The Font'.

'These two figures on the font in the marble church near St. Asaph in North Wales appealed to me as a portrait photographer.'

Mr. Swarman has partitioned off one end of the garage of his home in Rhyl, North Wales, to make a compact dark room. Most of his equipment, apart from cameras, he makes himself with the precision of a fine mechanic. The garage is also his studio and he usually works with a Leica and studio lights.

'This picture was the exception. I used no lights: just daylight with reflectors and an old plate camera worth about £5. To me, photography is painting with light. I get very interested in a face and want to bring out the character.'

BOB MITCHELL, a metallurgist in the Engineering Development Laboratory at Runcorn, 40 years with ICI, won the Brett Trophy for monochrome prints with 'Going Astern'.

'This frothy white wake caught my attention while we were on holiday at Ilfracombe last year – the *Bristol Queen* is the last paddle steamer to operate in the Bristol Channel.

'I have four cameras. This was taken with a Zeiss Werra. I don't go in for a lot of fiddling around – just stick on a two-times yellow filter and do more or less everything with that. Photography is my only hobby now. I do my developing and printing in the washhouse. A piece of black polythene blacks out the window. I'm much more interested in black and white than colour.'

ARNOLD HUGHES, assistant plan registrar with Mond Division Engineering Department at Runcorn, remembers the beginnings of the exhibition 14 years ago.

'It really started as part of a sale of work to raise funds for the Social and Recreational

Committee. A small display of photographs was being mounted and John Bradbury and I suggested having an art section.'

A regular exhibitor ever since, Mr. Hughes is one of a group of amateur artists who meet weekly at the ICI Weston Recreation Club to paint and offer criticism of each other's work.

'If I'm doing a portrait, I work in blocks of colour to achieve the shape of the face without any drawing at all. At first I couldn't get a likeness, then I gave up worrying about it and the likeness came.'

Portraits and the northern industrial landscapes of his home town appeal most. He works in oils with brush and pallet knife. He also does water colours, drawings and illuminated lettering.

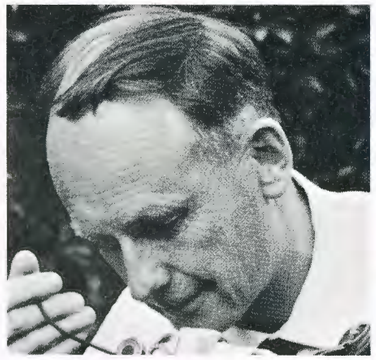
'Relaxing? It was when I first started. But the more you paint, the harder it becomes. I'm never satisfied with any of my pictures. The next one's always the best. One of my industrial scenes has been hung in an international exhibition in London – but it costs £5 to send a painting to one of those exhibitions so you can't do that too often.'

HOWARD NEWTON, a design draughtsman at Mond's Runcorn Headquarters, is a member of the Exhibition's organising committee. This picture of his sons Peter and Jonathan with their snowman was judged the best in the class for a set subject – 'Children at Play'.

'They were intent on building this snowman in the back garden. But you've got to be quick for this sort of shot. If they see me with a camera they are likely to put on a silly, cheesey grin.' Mr. Newton started conventionally with a box Brownie: now he's a 35 mm man. 'I always carry a camera and I make sure that there's always a film in it.'

REG WOOD is concerned with computer applications in Mond's Accountancy Department at Northwich. His 'Stained Glass circa

1967' won the open class for colour transparencies. 'I got my twelve-year-old daughter Jill to stand at the other side of a popple glass panel in the back door; put a flash on her side of the door and took the picture with my Asahi Pentax on a tripod. I don't go in for just shooting at random. To me photography is meeting a challenge to create an unusual effect.'



arabian way

Peter Skelton

'Meen al ahmar – who's the red one?' asked Arab officials when they spotted Peter Skelton among the brown Arab faces in a lorry crossing the desert lands of Saudi Arabia. A commercial assistant with Agricultural Division, he recently taught English for a year in this Moslem kingdom. During this time he travelled hundreds of miles along ancient caravan routes, in the great lorries which use them today. While the true nomad is becoming rarer, the ageless rituals and rhythms of the desert still hold good in the days of the internal combustion engine, the pattern of prayer still controls the long, hot days on the move.

Although massive 16-ton lorries have long replaced camels, the noise and commotion round the *mahatta* or station, the central square in any small Arabian town, where vehicles assemble just before dusk, is much as it must always have been. Sweating passengers struggle through the crowd with their bulging bundles, and load them into the truck. And while these vehicles, as mere machines, stay silent as luggage of all shapes and sizes is piled high inside, they roar even more loudly than camels when they start up. Meanwhile the drivers themselves clamour for customers, even tugging at their clothes, and the world swarms around looking on.

And a motley world it is – urbane Saudi Arabians in flowing white robes, bare-footed Bedouin with long, matted black hair, wild eyes, and bright red head-dresses; flamboyant-skirted Yemenis with curving daggers, their dark curly hair pushing out from beneath their conical hats. Then there are Jordanians and others, conspicuous by their European clothes, more sullen and reserved, and clicking their strings of 'worry beads' (not unlike a Catholic rosary) from one hand to another.

Aloof from all these, with the calm that accompanies authority in Arabia, stands the *dallal* or station master. He co-ordinates the movement of the lorries, tells prospective passengers when they depart, and makes up the passenger lists, which he then hands over with great dignity to the policeman in charge. A full load assembled, fierce bartering about the fares begins, the passengers threatening to dismount, the driver refusing to leave until at least six more have been recruited to make up for the low fare each is paying. Now this is possible, because apart from those who sit in the more expensive seats next to the driver and above the cab in the 'basket' (a large platform where you can sit and dangle your legs over the windscreen) everyone crowds in the rear and perches among the baggage. The haggling goes on, till the sun sets and it is time for the evening prayer. All differences forgotten, everyone gets out again and troops off to the mosque.

Just after sunset has always been the most popular time to leave, partly because this, and not midnight as in the West, marks for the Moslem the beginning of a new day. By contrast with the chaos surrounding the arrangements for the journey, the departure itself is quick and without fuss. A cursory nod to the policeman, a chorus of commendations from bystanders to the safekeeping of Allah, and the lorry roars down the street and out into the open desert.

Like the old camel caravans, the lorry never goes far the first night. This used to be to allow the well-wishers to spend the first night with it and also for anything forgotten to be fetched from the first night's camp. The tradition remains, although the reason for it has gone. So the lorry stops after a few hours – say fifty miles out in the desert. The night prayer will be said, and the evening meal or *ashia* follows. Everyone helps to gather firewood and as the embers glow and the *naseem*, the cool evening breeze, caresses faces still burning from the day's heat, the company settles down and the *samar* – an evening of recitals, songs, or stories – begins.

Oldest and strongest of Arab travel rituals, these *samars* may last any length of time according to the mood of the gathering. The ones I was at tended to go on and on – endless religious discussions, lessons from the Koran, or fierce arguments. In my turn, I would relate the wonders of the modern western world, which held the company spell-bound: how a rocket had been landed on the moon (at which one incredulous youth protested: 'What, the moon of my Lord?' – the moon having deep religious significance in Islam); how Eskimos lived among deserts made of ice; and how in Norway the sun never set in summer. This news rather shook the Arabs because during one month in each year (in rotation), they must fast from sunrise to sunset. What then would happen if a strict Moslem visited Norway in summer?

Slowly, as conversation dies with the embers of the fire, everyone pulls his weary body on board the lorry again. Tired though they are, the rush of the wind, the ghostly shapes of bushes or animals caught in the headlights, and the jewelled stars overhead, make the night ride exhilarating. Often a greater distance is covered by night than by day. A few hours before dawn the lorry halts. Wrapping themselves tightly in their clothes, everybody flops down on

The low road – a struggle through a sea of sand

Photographs: Peter Skelton

The rail road – traces of the former Turkish railway

The high road – a pilgrim way through the mountains above Mecca

ICI magazine

Leather look '68. Leather and suede fashions, tipped for even greater popularity this winter, now come in a wide range of exciting colours. Many, like this fuschsia pink 'ton-up' jacket by Morel in aniline hide grain by Strong and Fisher are dyed with ICI Procion dyes. Advantages of using Procion dyes for leather are the clear, bright shades obtainable and colour fastness to dry-cleaning and washing.